

FIGS. 1-3. Figs. 1 and 2. Metaphase I in triploid *Ageratum*. 1. 9 III + III + II. 2. 10 III. Fig. 3. Late anaphase I showing laggards. All  $\times 1,000$ .

hybrid shows a great degree of genetic similarity between parental genomes.

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## ENDOTHECIUM IN CYPERACEAE

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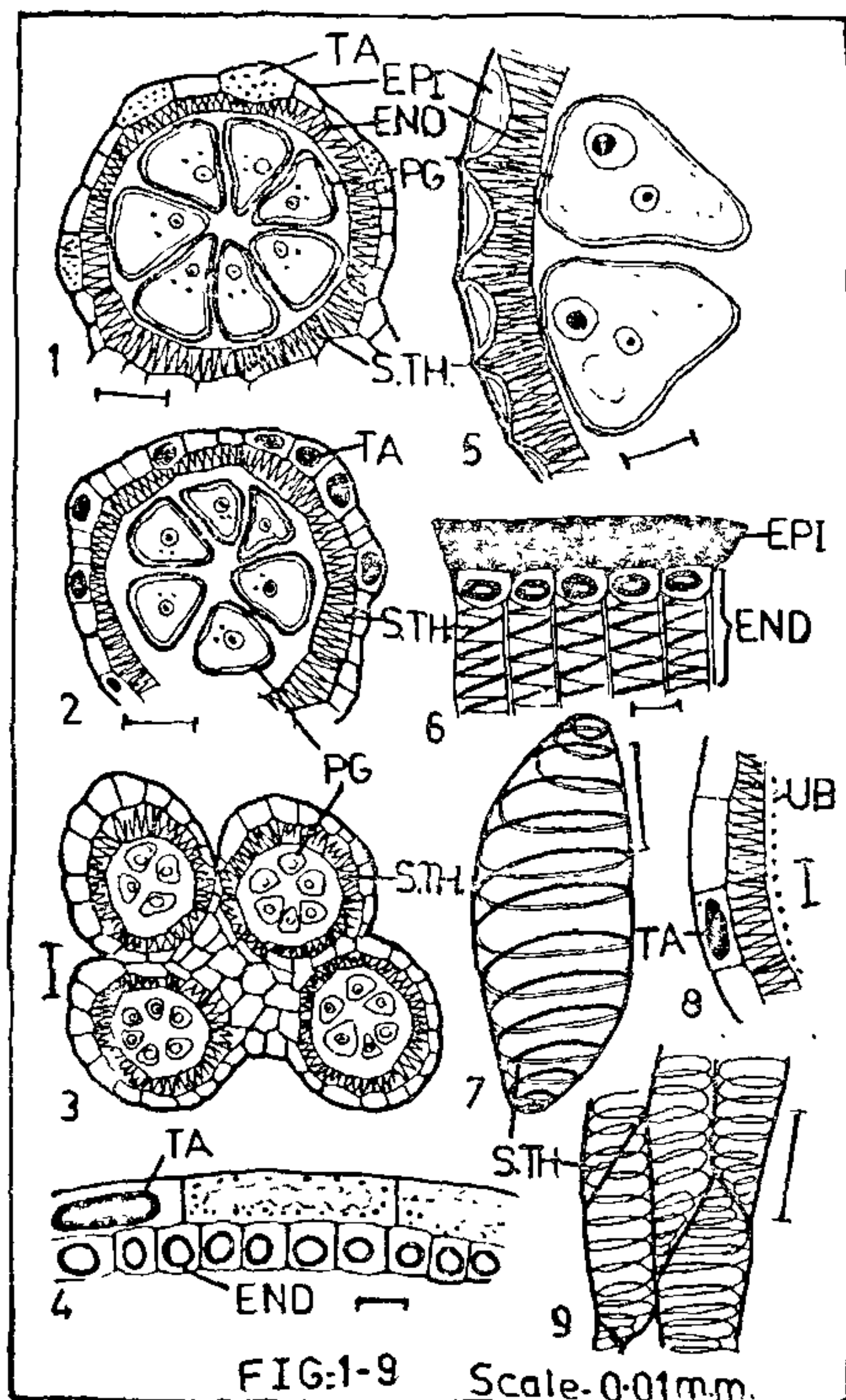
THE paper deals with the nature of endothecium in the mature anthers of Cyperaceae. Earlier reports indicate that the thickenings of the endothelial cells to be fibrous in nature<sup>2,4,5,8,9,11,12</sup>. The present study covers 47 species and 18 genera\*.

Microtome sections both L.S. and T.S. of mature anthers were examined. In addition, the endothelial cells from fresh material were macerated, stained with phloroglucinol and mounted in glycerine. During maceration, the connective region of the anther was isolated.

The epidermis invariably persists as a single layer till anthesis (Figs. 1-3). The endothelial cells are hypodermal, elongate at right angles to the anther epidermis (Figs. 4-6, 8) and are slightly tapering at both ends. They become cleared in macerated material. The nature of the endothelial thickenings in the species under investigation is quite interesting in being spiral and not conforming to the usual fibrous type met with in several other angiosperms<sup>1,6</sup>. In the taxa studied here, the spiral thickenings originate at one of the tapering ends and extend towards the other (Figs. 7, 9). The thickenings may be close or lax. When such lax spirals are observed in transections, they look very much like the fibrous thickenings on the endothelial walls. This has probably led several earlier workers to consider it as fibrous type.

Embryological literature dealing with anther development including Cyperaceae reveals that, invariably

\* *Kyllinga triceps* Rottb., *K. brevifolia* Rottb., *K. monocephala* Rottb.; *Pycneus pumilus* Nees., *P. puncticulatus* Nees., *P. latespicatus* C. B. Clarke; *Juncellus alopecuroides* C. B. Clarke; *Cyperus difformis* Linn., *C. compressus* Linn., *C. eleusionoides* Kunth., *C. tegetum* Roxb., *C. imbricatus*; *Mariscus paniceus* Vahl., *M. siberianus* Nees.; *Courtosia cyperoides* Nees.; *Eleocharis plantaginea* Br. Prod., *E. atropurpurea* Kunth., *E. capitata* Br. Prod.; *Fimbristylis tetragona* Br. Prod., *F. schoenoides* Vahl., *F. dichotoma* Vahl., *F. diphylla* Vahl., *F. miliacea* Vahl., *F. complanata* Link., *F. monostachya* Hassk., *F. cymosa* R. Br.; *Bulbostylis barbata* Kunth.; *Scirpus supinus* Linn., *S. mucronatus* Linn., *S. squarrosus* Linn., *S. royelei* Nees.; *Eriophorum comosum* Wall; *Fuirena ciliaris* Kunth., *F. wallichiana* Kunth.; *Lipocarpa argentea* R. Br., *L. sphacelata* Kunth.; *Rhynchospora wightiana* Steud., *R. glauca* Vahl.; *Remirea maritima* Aubl.; *Hypolirium latifolium* L. C. Rich.; *Scleria lithosperma* Roxb., *S. tassellata* Willd., *S. biflora* Roxb., *S. stocksiana* Bock., *S. hebecarpa* Nees.; *Carex filicina* Nees, *C. wallichiana* Prescott.



FIGS. 1-9. Endothecium in Cyperaceae. Fig. 1. T.S. anther of *Rhynchospora wightiana* showing endothelial cells with spiral thickenings; note granules in the papillose cells of epidermis. Fig. 2. Same of *Scleria stocksiana*. Fig. 3. Same of *Eriophorum comosum*. Fig. 4. L.S. anther (in part) of *Scirpus supinus*. Fig. 5. T.S. anther (in part) of *Eleocharis plantaginea*. Fig. 6. Epidermal cells over endothelial cells in macerated material. Fig. 7. Single macerated endothelial cell showing single band of spiral thickening. Fig. 8. T.S. anther (in part) of *Pycnus pumilus*; note 'ubisch' granules. Fig. 9. Endothelial cells in surface view.

(EPI = epidermis, END = endothecium, PG = Pollen grains, S.TH = Spiral thickening, TA = tannin, UB = Ubisch granules.)

the endothelial layer, with or without the epidermal cover, was normally described as fibrous<sup>4,6</sup>. Many of such observations are however, based only on serial microtome transections and no attempt is made to study this aspect in whole mounts of the material or macerated anther. Eames<sup>3</sup> has reported different types of thickenings on the endothelial layer but there

is no mention about spiral thickenings. This layer in different taxa possesses bars which appears stellate, 'V' shaped, fused, scalariform in addition to the fingerlike outgrowths. The present investigation reveals clearly the spiral nature of the lignified thickenings in the endothelial cells in the family Cyperaceae and this seems to be interesting character of some taxonomic significance. Untawale and Bhasin<sup>14</sup> reported different types of endothelial thickenings in macerated material of 30 species of Monocots, making reference to spiral thickenings in the Cyperaceae. A reference to this feature was made in the more recent work<sup>7,10,13</sup>.

One important aspect is the similarity in thickenings found in the endothelial cells of anther, on the one hand and that of the vascular elements, especially, the protoxylem on the other. Views have been expressed previously on the analogy of these two but Eames<sup>3</sup> finds no phylogenetic significance. Probably similar types of thickenings have evolved independently in the endothelial cells as well as the vascular elements in the angiosperms.

Thus it looks, the family Cyperaceae is characterised by the presence of endothecium which may be designated as "spiral endothecium" and earlier reports of its being fibrous need verification.

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